

## Five ways to accelerate power interconnection in Asia

The fifth in a 2020 series of webinars from the Clean Energy Ministerial Regional and Global Energy Interconnection Initiative

**June 23, 2020 1200(GMT)/2000(GMT+8, Beijing Time) Duration: 1 hour**

**Event Link: <https://meeting.tencent.com/s/YmHgX0laL6IK>(Conference ID:249 798 247)**

**Speaker: Dr. Yongping Zhai (Asian Development Bank)**

The webinar will elaborate:

- How to efficiently accelerate power interconnection in Asia?
- What is the implication for power interconnection under the post COV-19 circumstances?



**Dr. Yongping Zhai, Chief of Energy Sector Group, Asian Development Bank (ADB), in charge of overall energy operations coordination, and knowledge partnership in Asia and the Pacific region. Prior to his current position, Dr Yongping Zhai was Director, South Asia Energy Division (2010-2015), ADB, covering energy sector operations in Bangladesh, Bhutan, India, Maldives, Nepal and Sri Lanka. He served as ADB's Principal Energy Specialist (2000-2010) in charge of energy sector in Southeast Asia including Indonesia, Philippines, Vietnam and the Greater Mekong Subregion (GMS). Prior to joining ADB in 2000, Dr .Zhai worked for African Development Bank from 1993 to 2000. Dr. Yongping Zhai graduated from the Thermal Energy Engineering Department, Tsinghua University, Beijing, China (1983) and received a Ph.D in Energy Economics from Institute of Energy Economics and Policy in Grenoble, France (1989), and worked as Assistant Professor on Energy Planning and Policy at Asian Institute of Technology based in Bangkok (1990-1993).**



### About the Regional and Global Energy Interconnection (RGEI) Initiative

The RGEI Initiative was established at the 9th Clean Energy Ministerial meeting in Copenhagen/Malmö in May 2018. RGEI's objectives are to:

- \* Discuss conducive policy and regulatory framework regarding regional and global power system integration
  - \* Build consensus on facilitating energy transition via increased proportion of renewable energy in energy consumption and enhanced grid interconnection
  - \* Encourage CEM member countries to engage in the process of RGEI and seize collaborative opportunities
- CEM Members: China, Chile, Finland, Korea, South Africa, United Arab Emirates. RGEI works with other regional and national technical organizations in the field of power system integration including State Grid Corporation of China, the Korea Electric Power Corporation, and others.

Operating Agent: Global Energy Interconnection Development and Cooperation Organization (GEIDCO)

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RGEI Link: <https://www.cleanenergyministerial.org/initiative-clean-energy-ministerial/regional-and-global-energy-interconnection-rgei-initiative>

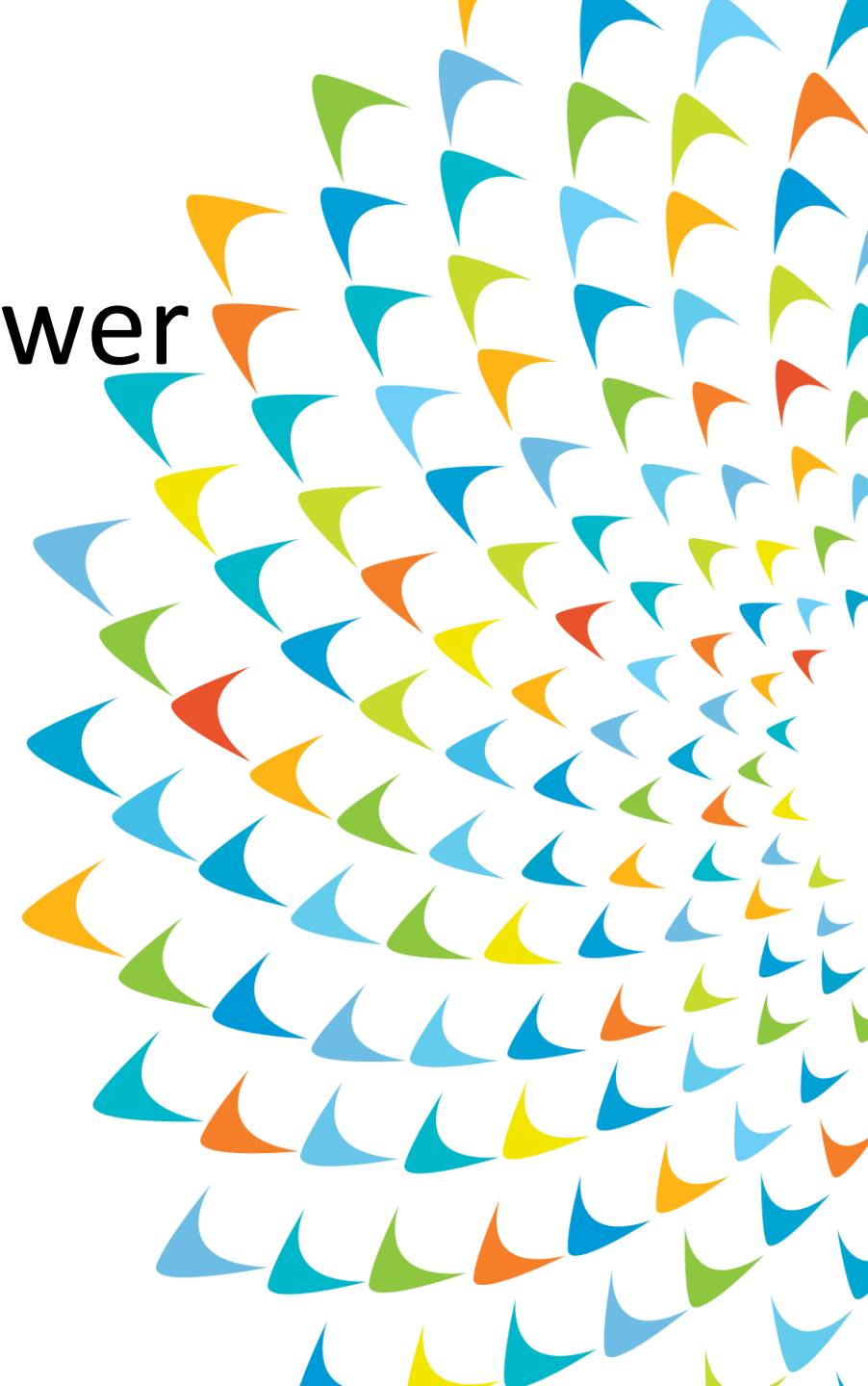
GEIDCO Link: <https://www.geidco.org> 



# Five Ways to Accelerate Power Interconnections in Asia

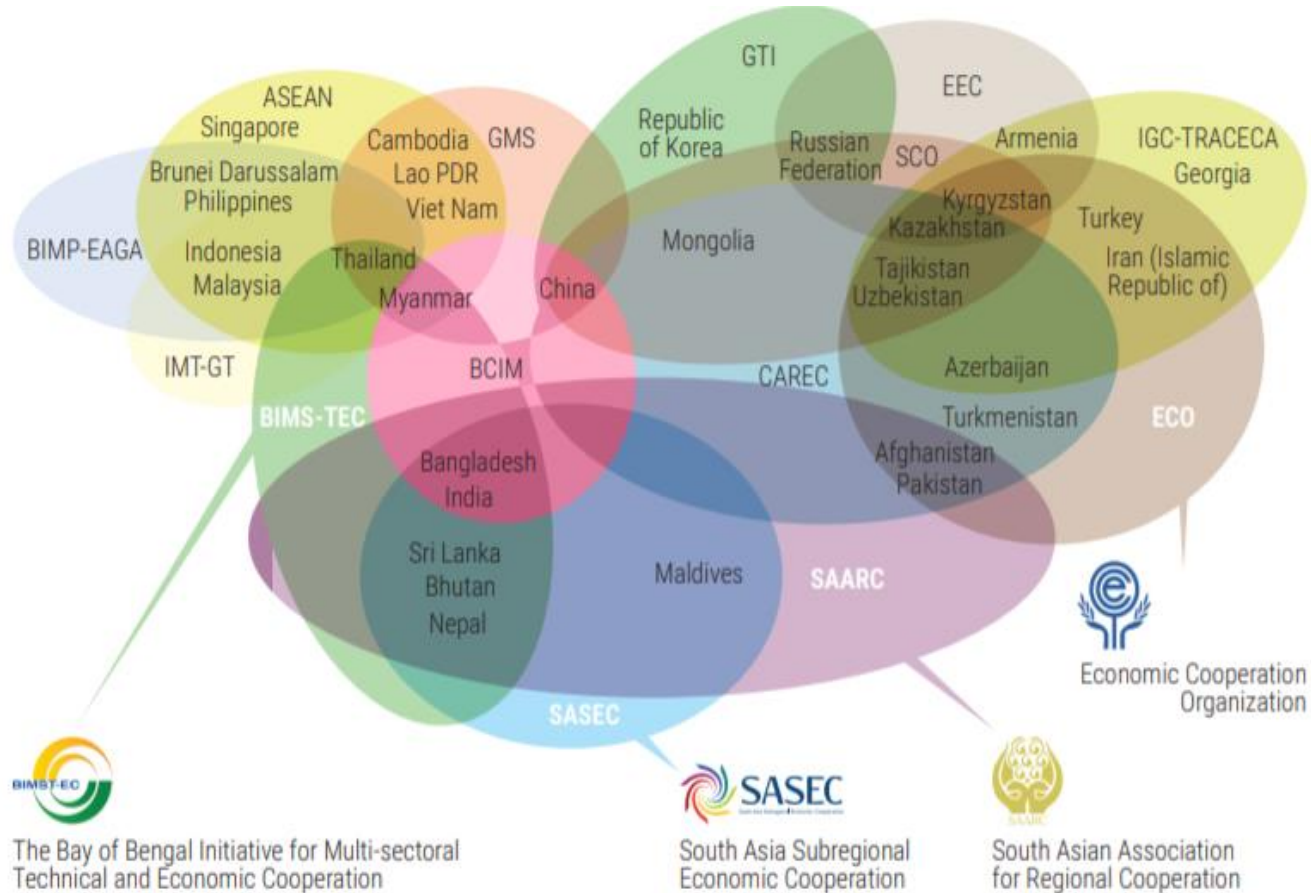
***Yongping Zhai***  
***Chief of Energy Sector Group***  
***Asian Development Bank***

***23 June 2020***





# Cooperation Initiatives across Asia



ADB directly initiated:

**CAREC**  
(Central Asia Regional Economic Cooperation )

**SASEC**  
(South Asia Subregional Economic Cooperation)

**GMS**  
(Greater Mekong Subregion Economic Cooperation)

**BIMP-EAGA**  
(Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area)

Source: ESCAP



# Five ways to accelerate power interconnection in Asia

- 1) Political & policy: building mutual trust through interconnection
- 2) Economic & financial: making interconnection viable
- 3) Environmental & climate: contributing to reduce pollution, and low carbon transition
- 4) Technical & technology: letting engineers to innovate
- 5) Financing & honest broker: mobilizing commercial funding

Reflection: what are about impacts of COVID-19?



# 1) Political & Policy

- Trust vs. Distrust:

Power interconnection can establish and enhance countries mutual trust, improve relations

- Energy Security vs. Insecurity:

Power interconnection can improve countries' energy supply security, more interconnected, more secure

- Consensus Building & institutional:

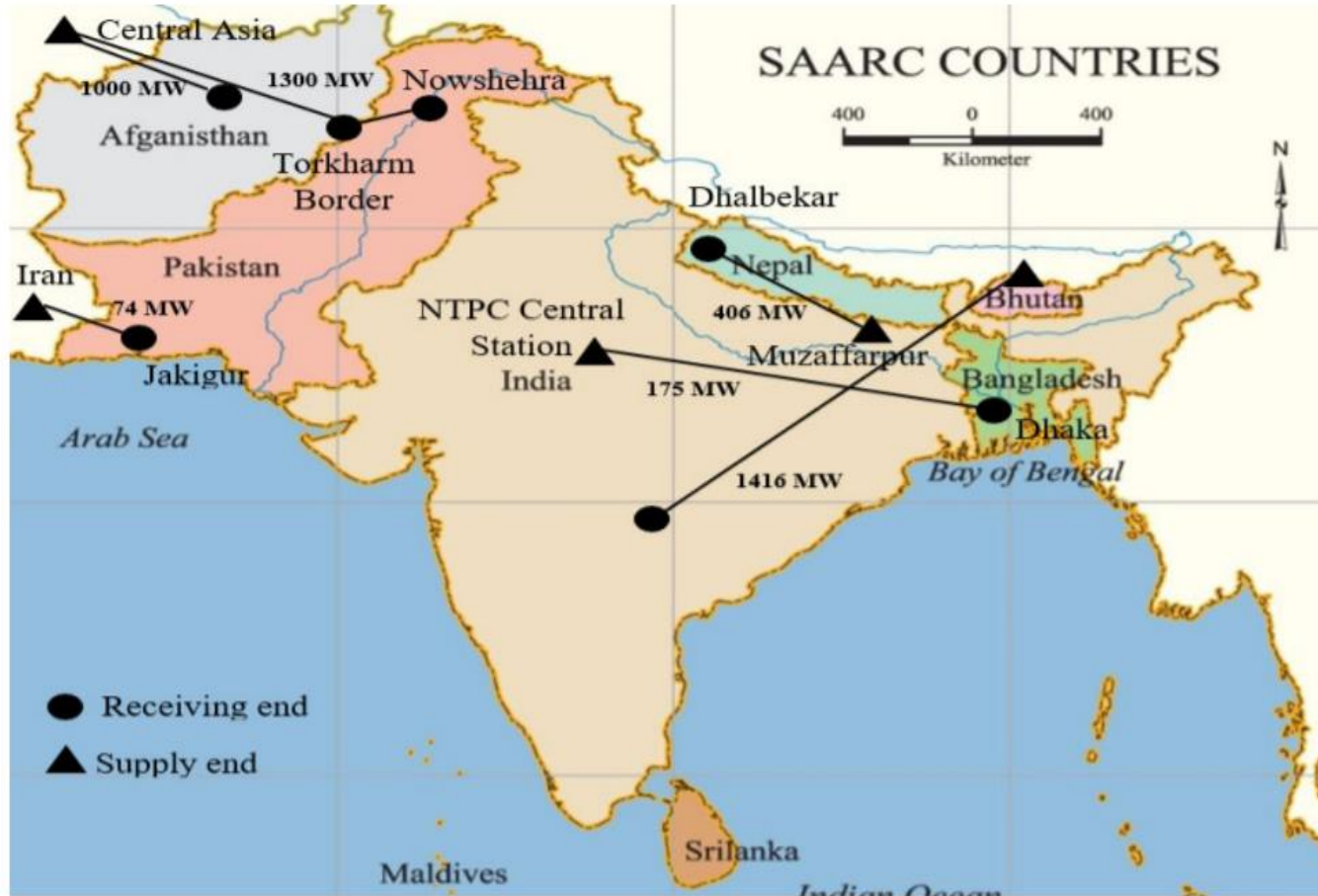
Need a “champion” country that has strategic vision to lead the power interconnection, build and support necessary institutions.





# Example: Power trade in South Asian Countries

## Role of a Champion!



Cross Boarder Trade in South Asia:

India – Bangladesh: 1140 MW

Bhutan-India: 2100 MW

India-Nepal: 500 MW

2012: 1400 MW

2015: 2126 MW

2018: 2986 MW

2020: 3760 MW

Planned:

Bhutan-Bangladesh (1GW); Nepal-Bangladesh (3 GW) through India

Source: <https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8928599>



## 2) Economic & Financial

- Financial (company level): Positive Net Present Value

Power trade and interconnection should generate positive cash flow for stakeholders.

- Economic (country & regional level): Optimizing energy sources on regional basis

High voltage power interconnection can make full use of potential of energy resources, particularly clean energy resources such as hydro, wind, and solar. A regional “least cost” development plan is needed.

- Power trade in border areas for energy access

Providing access to rural households from a neighboring country’s (lower-voltage) distribution network, this will be cost effective option for electricity access.



## Example: Connectivity for Electrification in Border Areas

- In Greater Mekong Subregion, various medium- and low voltage (from 115 kV and below) interconnections for energy access in border areas:
  - Lao PDR and Cambodia for 10 MW export to Cambodia through a 22 kV connection in the Steung Treng area;
  - Lao PDR and Thailand for power supply to five locations in Lao PDR border areas and exchange of power via 115 kV transmission lines in another five locations;
  - Lao PDR and Viet Nam for low-voltage connections in six locations;
  - Yunnan Province in China and Viet Nam for power supply to Viet Nam through four 110 kV links;
  - Thailand and Cambodia for up to 80 MW exports to Cambodia via a 115 kV transmission line serving western Cambodia and for another 40 MW export capacity to Cambodia via 22 kV connections to deliver power to seven border communities;
  - Viet Nam and Cambodia via 22 kV connections in 12 locations.





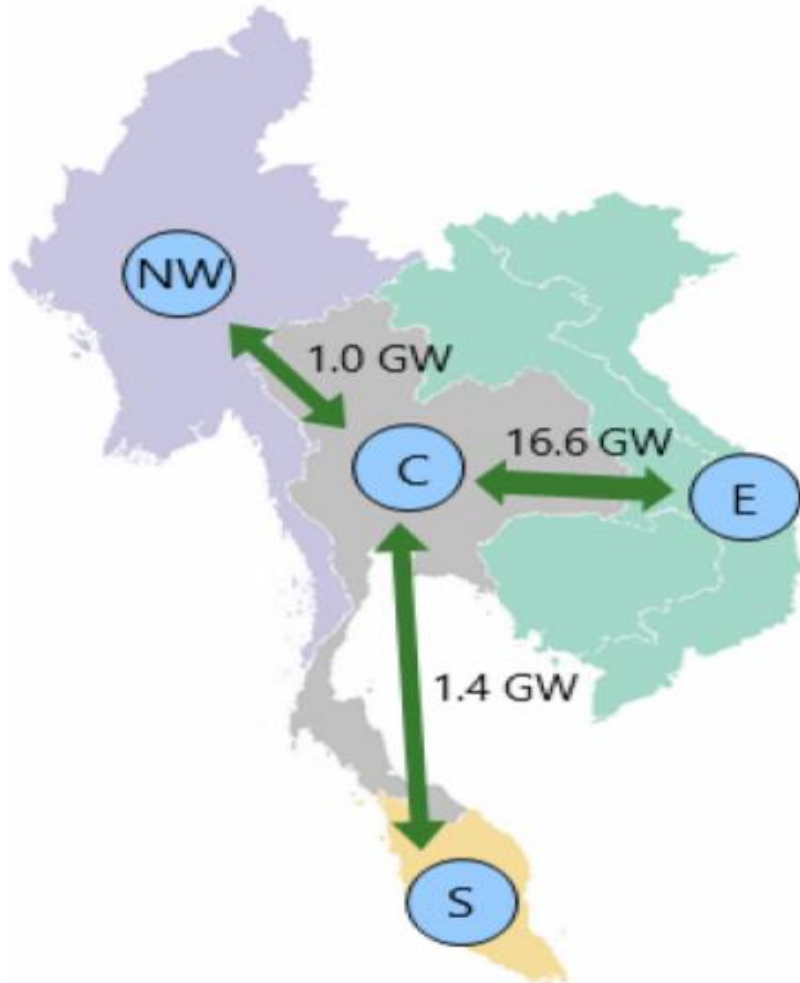
### 3) Environmental & Climate

- Environmental issues (mitigating negative impact):
  - Special consideration to transboundary impacts and sharing of benefits.
  - Addressing environmental impacts in natural borders.
  - Facilitating the development of high environmental standards.
- Climate issues (positive impact)
  - Maximizing renewable energy share in the region, reducing dependence on fossil fuels, so to reduce CO2 emissions
  - Introduce carbon price/taxes

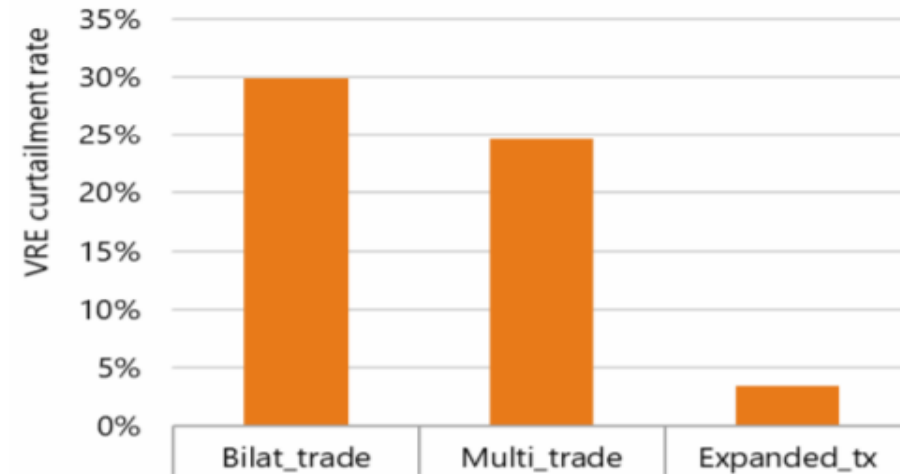


# Example: ASEAN Renewable Energy Integration

Capacity of the interconnectors



VRE curtailment for high VRE (~25%)



According to IEA, 13 GW of cross-border interconnectors can be added to the existing capacity (6 GW), enabling trade of low-cost generation, particularly hydro and variable renewable energy, from the Eastern region. This will help reduce curtailment of wind and solar power generation.



## 4) Technical & Engineering



### Trans-Himalayan power line project remains on the drawing board

The plan envisages building an electric transmission line linking Rasuwagadhi and Kerung.



The trans-Himalayan transmission line project has been highlighted by the government in its Transmission System Master Plan for the period 2015-35. SHUTTERSTOCK

.....only if all political, economic, environmental dimensions are handled, all technical & technology (standards, grid codes, engineering, UHVDC) issues can be resolved.



# Example: Australia-Singapore Power Link



The Australia-Singapore Power Link project also known as 'Sun Cable' is a proposal to connect a future 10 GW, battery-supported solar PV array near Tennant Creek in Australia's Northern Territory to Singapore via a 3,800-km undersea cable.

If successful, the project would supply up to 20 per cent of Singapore's power needs with "stably priced, dispatchable power" while supporting development of the world's largest solar farm.

The issue is not technology, but financial, and environmental impact, and political.



## 5) Role of Asian Development Bank

- Regional cooperation and integration is one of the 7 operational priorities of ADB.
- Power interconnection is the key infrastructure of regional cooperation and integration.
- ADB Energy Policy:

*“Regional cooperation can play a vital role in ensuring energy security in a sustainable manner. Subregional power trade can help meet energy demand while maximizing scarce natural resources. By utilizing different peak times of neighboring countries, regional power trade can reduce the need to build new power generation plants in each country. ADB can play a pivotal role in promoting effective regional cooperation on energy.”*



## ADB as Honest Broker

- ADB initiate regional initiatives such as GMS, CAREC, SASEC etc.
- ADB convenes and co-chairs regional power trade coordination meetings.
- ADB can serve as Secretariat of power trade coordination committee.
- As requested by member countries, ADB can provide advisory services and expert support to power trade agreement negotiation process.





# ADB as Knowledge Facilitator

- ADB supports and conducts studies on the potential of regional power interconnection covering all sub-regions (Southeast Asia, South Asia, Northeast Asia, Central and West Asia) .
- ADB organizes regional forums/workshops on regional power interconnections to share knowledge.
- ADB sponsors field visits to successful power interconnection projects, and regional power markets to learn technologies, market regulations.
- ADB supports regional electricity regulators' networks for sharing best practices.



# ADB as Development Financier

- ADB can provide concessional loans to member countries for building power interconnection infrastructure.
- ADB established a Regional Cooperation and Integration Fund (RCIF), to provide grant resources for conducting feasibility studies, detailed design and supervision consulting services for regional connectivity projects including power interconnection projects.
- ADB, as lead financier, can mobilize co-financing from other development banks and commercial banks to support regional power interconnection.



# ADB in Action: Southeast Asia (GMS)

- ADB initiated Greater Mekong Subregion cooperation including Cambodia, the Lao PDR, Myanmar, Thailand, Viet Nam, and the Guangxi and Yunnan, China.
- ADB supports Regional Power Trade Coordination Committee (RPTCC) was established in 2004. Last RPTCC-26 was held in Ha Noi in November 2019, discussing the Grid Code.
- Four stages of regional power trade and interconnection is envisaged - GMS example:

Stage 1	✓ bilateral cross-border connections
Stage 2	○ grid-to-grid power trading between any pair of GMS countries
Stage 3	○ development of transmission links dedicated to cross-border trading
Stage 4	○ competitive regional market



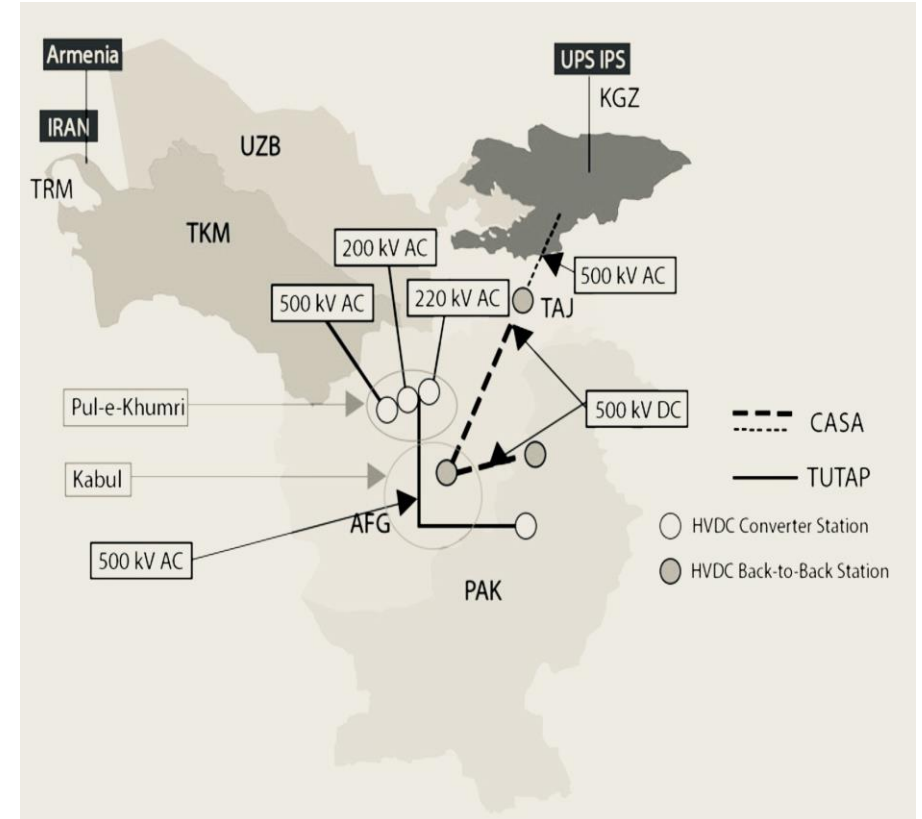
# ADB in Action: South Asia

- ADB initiated South Asia Subregional Economic Cooperation (SASEC), including Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, and Sri Lanka.
- SASEC Electricity Transmission Utility Forum first held in 2013. Since then much progress has been made in physical project implementation.
- 5 countries interconnected through the India's grid:
  - ✓ India → Bangladesh (400 kV, 132 kV upgraded to 400 kV)
  - ✓ India ← Bhutan (400kV, 220 kV, 132 kV)
  - ✓ India → Nepal (132 kV to be upgraded to 400 kV, 66 kV, 11 kV)
  - ✓ India → Myanmar (11 kV)
  - ✓ India → Sri Lanka (400 kV) – Under discussions



# ADB in Action: Central and West Asia

- ADB initialed Central Asia Regional Economic Cooperation (CAREC) , including Afghanistan, Azerbaijan, China, Georgia, Kazakhstan, Kyrgyz Republic, Mongolia, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan.
- ADB provides financing to various segments of Turkmenistan-Uzbekistan-Tajikistan-Afghanistan-Pakistan (TUTAP) power interconnection initiative to export power from Turkmenistan, Uzbekistan, and Tajikistan to supply the Afghan grid with excess power to be exported to Pakistan.





# ADB in Action: Northeast Asia

- ADB technical assistance grant to study “Strategy for Northeast Asia Power System Interconnection” (by EDF) to study large scale renewable generation from Mongolia (Gobi Desert) to load centers in Northeast Asia Power System Interconnection (NAPSI) countries.

Investment Cost – Scenario 1 Integrated AC Configuration MON Export 5GW 2026

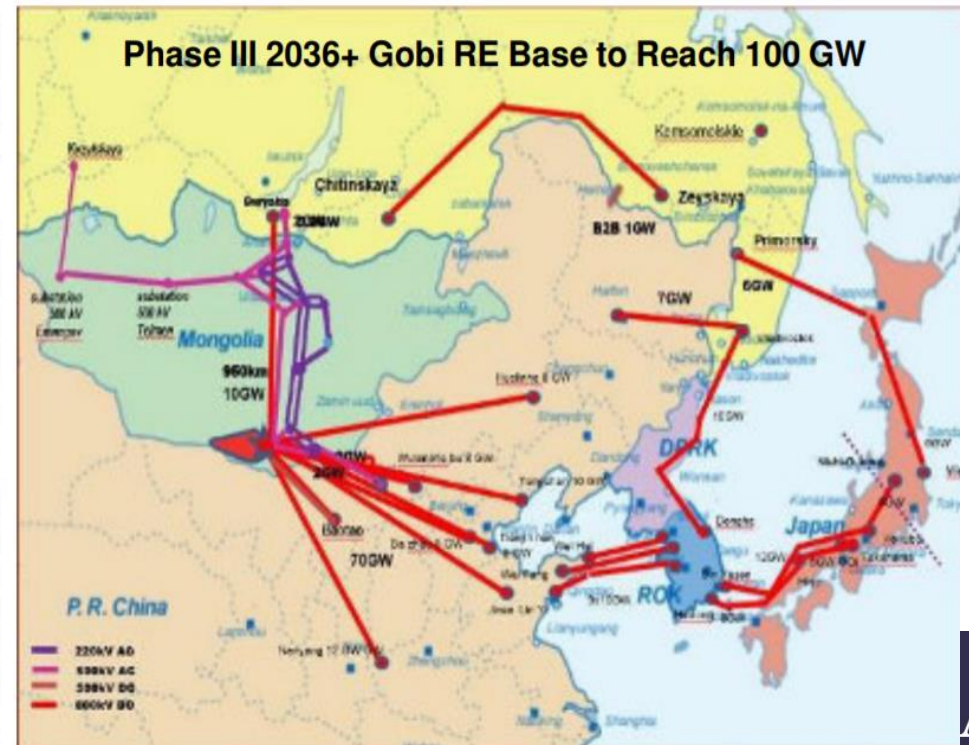
Interconnection Russia-MON-PRC-ROK with MON Export 5GW	3273
Additional interconnection with Japan	3135
Additional interconnection Russia-DPRK-ROK	967
<b>Total</b>	<b>7375</b>

Investment Cost – Scenario 2 Integrated AC Configuration MON Export 10GW 2036

Interconnection Russia-MON-PRC-ROK with MON Export 5GW	3273
Additional interconnection with Japan	3135
Additional interconnection Russia-DPRK-ROK	967
Additional Interconnection MON-PRC-ROK with additional MON Export 5GW	1763
<b>Total</b>	<b>9138</b>

Investment Cost – Scenario 3 Integrated AC Configuration MON Export 100GW 2036+

Interconnection Russia-MON-PRC-ROK with MON Export 5GW	3274
Additional interconnection with Japan	3135
Additional interconnection Russia-DPRK-ROK	967
2nd additional interconnection Russia-DPRK-ROK	1964
Additional Interconnection MON-PRC-ROK with additional MON Export 5GW	1763
Additional Interconnection Russia MON-PRC-ROK-Japan with additional MON Export 90GW	51 854
<b>Total</b>	<b>62957</b>







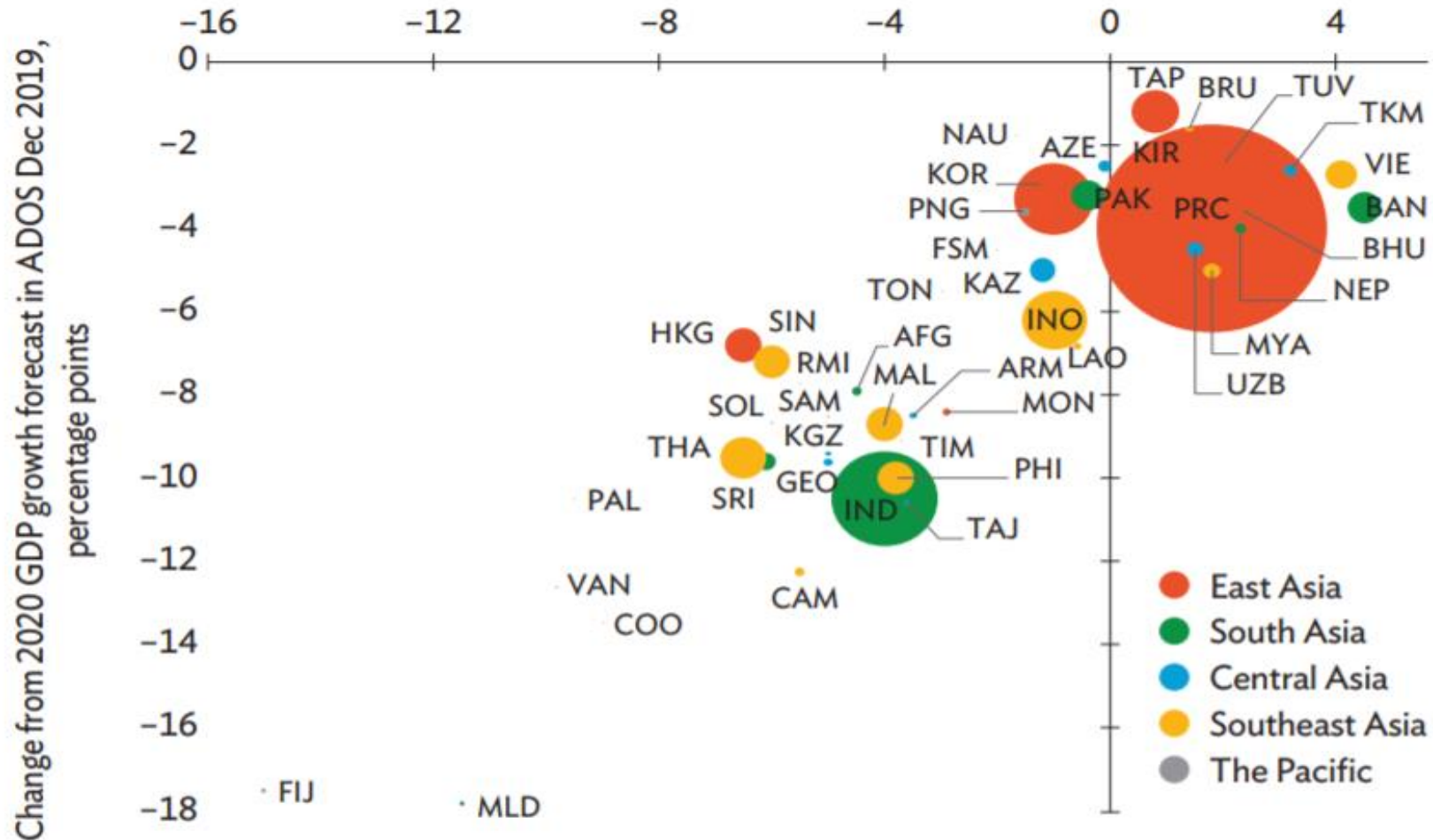
# ADB in Action: Pacific Region

How do we promote regional cooperation in the Pacific Region?

- Electricity interconnections not practical in general, but other energy trading may be viable:
  - Bio-based energy (biomass / biogas / liquid fuels)
  - Power to gas (CH<sub>4</sub>, H<sub>2</sub> for export)
  - Power to other value-added products (high-value bio-based chemicals)



# Impact of COVID-19 Pandemic: ADB Forecast GDP Growth 2020-2021



Source: Asian Development Outlook, Supplementary, 18 June, 2020, ADB



## Impact of COVID-19 Pandemic: ADB Forecast GDP Growth 2020-2021

	2019	2020	2021
China	6.1%	1.8%	7.4%
India	4.2%	-4.0%	5.0%
Bangladesh	8.2%	4.5%	7.5%
Pakistan	1.9%	-0.4%	2.0%
Indonesia	5.0%	-1.0%	5.3%
Thailand	2.4%	-6.5%	3.5%
Vietnam	7.0%	4.1%	6.8%
Philippines	6.0%	-3.8%	6.5%
Malaysia	4.0%	-4.0%	6.5%
<b>Developing Asia</b>	<b>5.1%</b>	<b>0.1%</b>	<b>6.2%</b>

Source: Asian Development Outlook, Supplementary, 18 June, 2020, ADB



## Summary of the Available Resources to Support COVID-19 Response

**Table 1: Summary of the Available Resources to Support COVID-19 Response**

<b>Financing Sources</b>		<b>Sovereign Operations</b>	<b>Nonsovereign Operations</b>
(i)	Mobilizing additional resources including:	\$13,754 million (ADF, COL, regular OCR, TASF, APDRF)	
	(a) Regular OCR	\$13,000 million <sup>a</sup>	
	(b) Concessional resources	\$704 million, of which <ul style="list-style-type: none"> <li>\$100 million (ADF)</li> <li>\$604 million (COL)</li> </ul>	
	(c) Grant resources	\$50 million, of which <ul style="list-style-type: none"> <li>\$40 million (TASF)<sup>a</sup></li> <li>\$10 million (APDRF)<sup>a</sup></li> </ul>	
(ii)	Re-programming of 2020 pipeline projects and programs	\$3,721 million, of which <ul style="list-style-type: none"> <li>\$2,710 million (regular OCR)</li> <li>\$800 million (COL)</li> <li>\$130 million (ADF)</li> <li>\$81 million (TASF)<sup>a</sup></li> </ul>	\$1,640 million, of which <ul style="list-style-type: none"> <li>\$800 million (TFP)</li> <li>\$840 million (from other projects and programs)</li> </ul>
(iii)	Re-allocation of existing resources from ongoing projects	\$366 million <sup>b</sup> , of which <ul style="list-style-type: none"> <li>\$343 million (COL)<sup>a</sup></li> <li>\$22.7 million (ADF)<sup>a</sup></li> </ul>	\$200 million (SCFP)
(iv)	Savings and cancellations of ongoing projects	\$281 million, of which <ul style="list-style-type: none"> <li>\$115 million (COL)</li> <li>\$166 million (ADF)</li> </ul>	
(v)	Making available existing grant resources	\$38.4 million, of which <ul style="list-style-type: none"> <li>\$17.3 million (TASF)</li> <li>\$21.1 million (APDRF)</li> </ul>	
<b>Total</b>		<b>\$18,160 million</b>	<b>\$1,840 million</b>



# Reflections: Impact of COVID-19 and Future of Energy Systems

- In large and mature markets where power networks and interconnection are strong, renewable energy emerged as winner with higher market share (as demand declines) => renewable energy seems “immune”
- Smaller utilities and off-grid companies suffered revenue losses and cash flow problems => ADB provided emergency support
- Many renewable energy projects suffered delays due to transport and travel restrictions => local capacity is needed in developing countries
- Building future resilient energy system
  - energy mix (fossil fuels, nuclear, renewable energy)
  - technology mix (hydrogen, storage, CCUS)
  - “grid mix” (large scale interconnected grids + grid connected micro-grids)



Thank you!

